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Closed reduction of radius refracture: A case report

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ABSTRACT

INTRODUCTION: Refractures of the radius and ulna in the paediatric patient with flexible intramedullary nails in situ are known to occur. There are no formal guidelines currently in the literature to guide the management of such fractures.

PRESENTATION OF CASE: A 10-year-old Caucasian girl, sustained a closed refracture of the radius at the same level, with the flexible intramedullary nails in situ to treat her recent ulna and radius fractures.

DISCUSSION: We proposed a new non-invasive way of reducing and maintaining such fractures without removal of the bent nail completely.

CONCLUSION: This method does not significantly reduce the mechanical strength of the nail, as we do not advocate applying an external lateral force, which would compromise nail mechanical strength and eventually lead to breakage of the nail in situ.

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1. Introduction

Refractures of the radius and ulna in the paediatric patient with flexible intramedullary nails in situ can occur raising debate on how they should be optimally managed. Such patients have commonly been treated with nails replacement following closed manipulation and reduction after a lateral bending force. Other reports of surgical intervention for satisfactory reduction include fixation using plate and screws, single bone nail, single bone plate, pin and plasters.¹

We present an interesting case of a refractured radius alone with nails in situ to both her recent ulna and radius fractures, treated by a small withdrawal of the nail to her radius by a few centimetres.

2. Case presentation

One year ago, a 10-year-old Caucasian girl, with a background of being fit and well, sustained a closed fracture of the distal third of the radius and ulna following a mechanical fall at school. She underwent a closed manipulation and reduction of her forearm followed by insertion of the flexible intramedullary nails to both radius and ulna. Fig. 1 shows satisfactory placement of the intramedullary nails to the radius and ulna following her initial injury. At 1 month follow up, her cast was removed and her primary fractures were healing well with evidence of good callus formation at the fracture site. Three months following her initial injury, she had a second accident, her sister rolled on top of her. She sustained a closed refracture of the radius at the same level. On re-examination, she was tender over the radial site and no neurovascular deficit identified. The fracture was oblique and had approximately 20° of volar angulation

of the radial nail. Fig. 2 shows a radiograph of her forearm with a refracture at the level of the junction between the middle and distal third of the radius. The previous ulna fracture showed good evidence of callus formation and nail position, with no evidence of refracture here.

The patient was taken to theatre and whilst under general anaesthesia, the distal intramedullary nail to the radius was exposed at the wrist and position reviewed under image intensifier. A tourniquet was used for the duration of the procedure lasting 36 min and prophylactic antibiotic cover with intravenous Cefuroxime (1.5 g) was given at induction by the anaesthetist. The nail was found to be in close contact with the extensor tendons but cutaneous nerve vessels were protected. The end of the nail was grasped firmly with a monkey wrench and under image intensifier the wire was pulled gently out so that the kinked aspect of the nail at the level of the fracture site was moved distally. This allowed the straight aspect of the proximal nail to lie at the fracture site, stabilising the fracture with good alignment whilst the kinked part of the wire laid in the wider metaphysis of the radius. After which, 'jail breaking' wire cutters were used to cut the excess wire at the wrist and buried beneath the skin. Fig. 3 shows the image intensifier radiograph of the satisfactory nail position checked intraoperatively. The small wound was washed with saline and closed with subcuticular vicryl stitches and steristrips. The arm was then put supported by an above elbow plaster in a neutral position with a broad arm sling.

Postoperative recovery was uneventful and the patient was discharged home. At 2 months follow up, the wound site was satisfactory, the patient was neurovascularly intact in that forearm, and the X-rays showed evidence of callus formation.

3. Discussion

The current literature to date concentrates on the management of primary paediatric forearm fractures. In primary forearm

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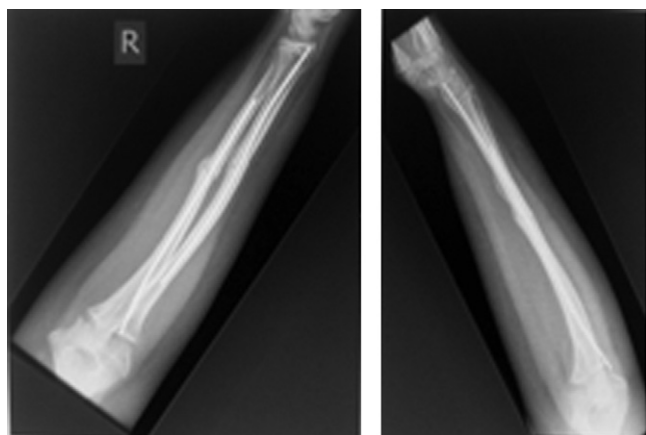


Fig. 1. Radiographs showing the initial fracture at the junction of the middle and distal third of right radius and ulna after fixation with flexible intramedullary nails.

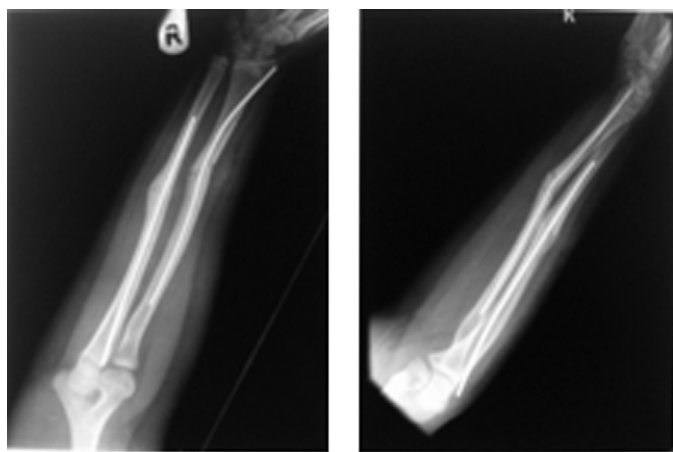


Fig. 2. Radiographs showing the refracture of the radius with intramedullary nails in situ to both radius and ulna.

fractures the gold standard for treatment of majority of paediatric 2-bone forearm fractures is closed reduction with cast immobilisation.² Perfect anatomic reductions of these fractures are not necessary in children, as their immature bones have the ability to remodel which may correct any residual deformity.³ It has been

reported that angulation of approx 10 degrees in children is likely to remodel overtime.³

Operative fixation is indicated in a minority of cases. This include fractures that are unstable, with an angulation of more than 10 degrees post closed reduction, displaced fracture of proximal third of radius, and in an open fracture.² Operative treatment options include nails, plates and pins and rushrods.² In the early 1980s, the French and Spanish research groups recognised management of forearm shaft fractures with the use of flexible intramedullary nails.^{4–6} This technique was developed to be the standard treatment of unstable paediatric forearm fractures.³ It has the advantages of a small surgical wound, short operative time and minimal neurovascular risk of injury. Most paediatric patients that undergo insertion of these intramedullary nails are placed in a cast for at least 4 weeks duration. Prolonged immobilisation in plaster is known to increase the risk of stiffness. These nails in paediatric forearms are usually removed 6–9 months post operatively as refracture may occur in 10% of cases if the nails are removed earlier.⁷ There are no formal recommendations regarding the routine removal of metallic intramedullary nails in children, however, the approach of elective removal of nails in children is widely accepted.⁸

As the incidence of refractures of the forearm with flexible intramedullary nails in situ is low, there are no formal guidelines for the management of this situation available.⁹ Different managements have been proposed over the years, and these include non-invasive and invasive methods.⁹ A non-invasive method consists of closed reduction by applying a lateral force to bend the nails back into position.⁹ Closed reduction is relatively quick to perform and have the benefit of being non-invasive. However, studies⁹ have shown that physically bending these nails would result in compromised proof stress, which significantly reduces the mechanical stability of the nails. This means that the average force required to bend a previously deformed nail was reduced by an average of 37%. In a case report by Muensterer and Regauer, a closed reduction performed was not only difficult but resulted in the breakage of the intramedullary nail.⁹

A small withdrawal of the flexible intramedullary nail method is minimally invasive and does not involve applying a lateral bending force to the flexible intramedullary nail. We believe that this technique will allow one to reduce and stabilise the refractured radius/ulna without compromising mechanical strength of the nails in situ at the fracture site. Other advantages of the small withdrawal method when indicated or possible compared to operative fixation with plates included reduced operating times, cost effectiveness, reduced risk of neurovascular injury, and better cosmesis.¹

4. Conclusion

We have highlighted a new means of managing refractures of the radius and ulna with the flexible nails in situ through a small withdrawal of the bent nails over a short distance. We recommend this to be an effective means of treating similar fractures.

Conflict of interest

The authors declare that they have no conflict of interest.

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None.



Fig. 3. Radiograph showing fracture alignment at 4 weeks after a small withdrawal of the nail.

Ethical approval

Written informed consent was obtained from the patient and parents for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in Chief of this journal.

Authors' contributions

MS, MY and JGS all contributed in writing the manuscript and performing literature review. MY collected the X-rays and reformatted them and obtained the patient's and parents consent. MS and JGS contributed to the discussion section and edited the manuscript. All authors read and approved the final manuscript.

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